DRAFT

STOCKWELL PONDS
TRIBUTARY SYSTEM WATER QUALITY
INVESTIGATION

October 2002

Prepared for:

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Lake Restoration

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INTRODUCTION

Lake Singletary is a popular water resource within the Towns of Milbury and Sutton, supplying seasonal recreation in the form of swimming, fishing, wildlife viewing, and boating. However, the lake experiences problematic growth of Eurasian Watermilfoil and the occasional microscopic algae bloom, which continues to impede recreational activities and negatively impact the ecological balance of the lake.

The Stockwell Ponds make up the majority of the Lake Singletary watershed and have therefore been identified in past studies as having an important role in the reduction of the external nutrient load. The 1995 Lake Singletary Watershed Management Plan makes recommendations as to the management of the Stockwell Ponds in order to foster and/or maintain their nutrient sumping capabilities.

Concerns over potentially declining water quality and increasing vegetation growth in the Stockwell Ponds prompted the Lake Singletary Watershed Association (LSWA) in conjunction with the Town of Sutton to seek a grant from the Department of Environmental Management's Lake and Pond Grant Program. The awarded grant monies were used to aid in the funding a limited water quality investigation of the Stockwell Ponds tributary system focusing on the development of long-term management strategies and goals.

This report is provided in fulfillment of the grant, with the intent of documenting existing conditions and the development of management strategies focusing on the maintenance and improvement of the Stockwell Ponds nutrient reducing function and capabilities.

METHODS

This water quality investigation can be broken into three primary tasks:

Task 1 – Morphometric investigation. The morphometric portion of the project included vegetation identification, plant community mapping, bathymetry mapping, and bottom sediment characterization. The field survey was performed on August 10, 2001. This work was performed by predetermining transect lines throughout the ponds. Sample sites were then randomly chosen along the transect lines. At each sample site a rake was dragged along the bottom to collect vegetation samples, a flat weight on a measuring tape was lowered to gauge water depth, and a graduated steel probe was forced into the top layers of the unconsolidated sediment in order to characterize the dominant type of material (muck, peat, sand, gravel, rock). The data collected as a result of these various tasks were recorded on a map corresponding to the location of the transect line and sample site. The data was then compiled to produce general plant community and bathymetry maps.

Task 2– Baseflow water quality sampling. Six separate sample collection sites were established throughout the Stockwell Pond system. The sample sites were located at the outlets of the six ponds; Welsh Pond, Putnam Pond, Schoolhouse Pond, Adams Pond, Arnold Pond, and Town Farm Pond (see Figure A, next page). Five separate sampling rounds were collected from these sites during base flow conditions, two in the late summer/fall of 2001 and three during the spring of 2002. The sampling rounds were spaced approximately one month apart. All the samples were analyzed by a MA DEP certified laboratory for the following parameters: total alkalinity, pH, total phosphorus, and dissolved phosphorus.

Task 3– Stormwater tributary sampling. Two stormwater sample sites were selected at strategic locations within the Stockwell Pond system. Two storm events were sampled during the March – May period. Three sampling rounds were collected from each of the two samples sites for each of the separate storm events, pre-storm, first flush, and post-storm or the waning part of the hydrograph. The samples were collected by Association volunteers under the direction of an Aquatic Control Biologist. The first flush samples were taken using common passive stormwater collection techniques. The samples were again analyzed by a MA DEP certified laboratory for the parameters listed under Task 2.

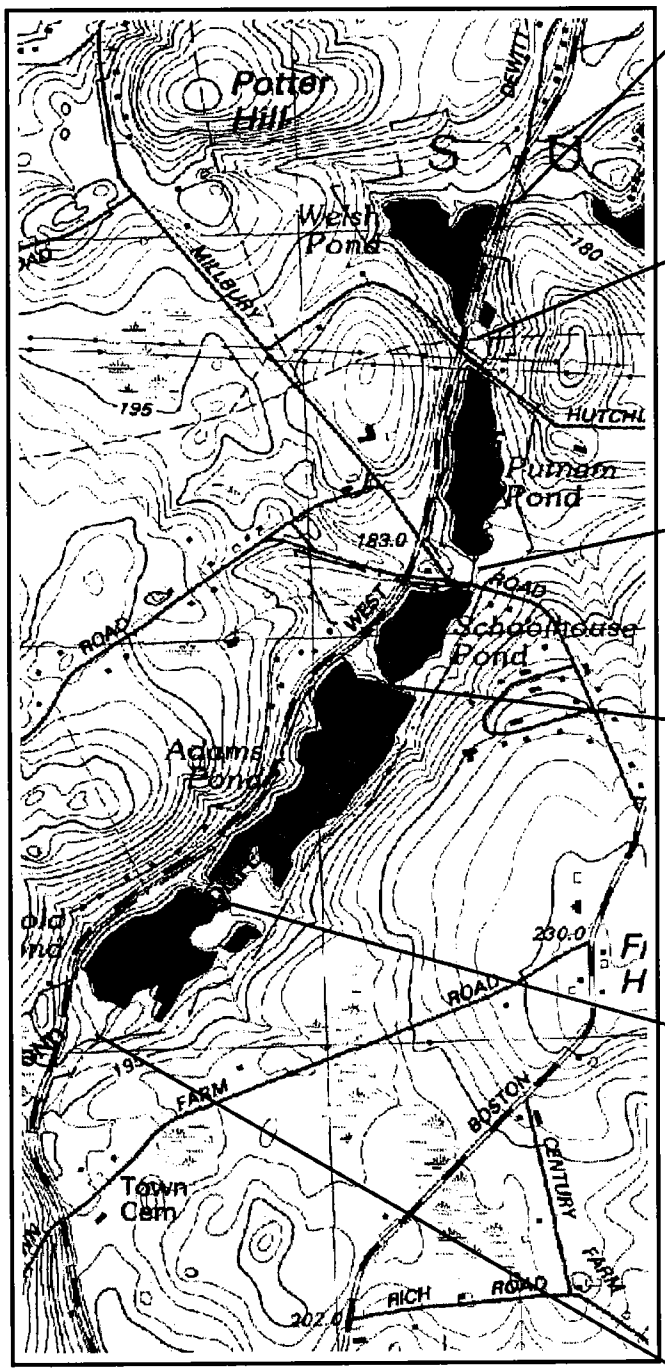


FIGURE A – Sampling Locations

Welsh Pond (WP-01-02) – Average depth of 2.5-3.0 ft. Dense submersed and emergent plant growth dominated by coontail, bladderwort, variable watermilfoil, floating-leaf waterlilies and various rush and sedge species.

Putnam Pond (PP-02) – Emergent cattail marsh with main water conveyance channel in center. Exotic emergent species purple loosestrife and Phragmites were also present. Several inches of ponded water observed among cattails.

Schoolhouse Pond (SP-03-13) – Very shallow (average depth ~ 1.0-2.0 ft.) with 100% cover of floating-leaf waterlilies. Submersed plant assemblage dominated by bladderwort.

Adams Pond (AP-04) – Approximately 50-60% covered with floating-leaf waterlilies. Dense contiguous growth of submersed plants as well. Submersed plant community is dominated by bladderwort and variable watermilfoil. Average depth ~4.0 ft.

Arnold Pond (ARP-05) – Shallow pond (average depth ~3.0-4.0 ft.) with encroaching emergent plants dominated by purple loosestrife, burr-reed, and pickerelweed. Abundant submersed growth observed throughout the pond. Species include variable watermilfoil, bladderwort, and floating-leaf waterlilies.

Town Farm Pond (TFP-06-12) – Intermittent stream running through a hard wood forest.

RESULTS & DISCUSSION

Morphometric Investigation

The morphometric phase of the investigation was conducted to gather data on the physical features/capabilities of the waterbodies to further guide the development of future management endeavors. Vegetation distribution and bathymetry maps are included as Appendix A.

Welsh Pond

Welsh pond is a shallow 8.5 acre impoundment that has a maximum depth of 4.0 ft. and an average depth of only 2.7 ft. The pond is heavily vegetated with a 4-5 acre area of dense waterlily canopy. Submersed species were observed throughout the pond; however, lesser densities were identified in areas where significantly less waterlily canopy occurred. The submersed plant assemblage consisted of (in order of relative abundance) coontail (*Ceratophyllum demersum*), variable watermilfoil (*Myriophyllum heterophyllum*), bladderwort (*Utricularia sp.*), thin-leaf pondweed (*Potamogeton pusilis*), and waterweed (*Elodea canadensis*). The vegetation distribution and bathymetry are provided in Figures 1 and 1a.

Putnam Pond

Putnam Pond is located directly upstream of Welsh Pond and, as a result of a dam breech, is now and emergent cattail marsh. The wetland area maintains a defined water conveyance channel that meanders through its center. In addition to the main channel, the cattails also maintain several inches of ponded water throughout the 9.2 area. Cattails dominate the emergent species. The exotic and invasive emergent plant purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*) were observed growing in the wetland; although the common reed was isolated to < 0.25 acre stand. Vegetation distribution can be viewed on Figure 2.

Schoolhouse Pond

Schoolhouse Pond is another shallow impoundment in the Stockwell Pond chain with an average depth of only 1.0-2.0 ft. As can be expected in a shallow waterbody there was a "healthy" emergent community extending from shore an average of 20-30 ft. The 6.7 acre pond was 100% vegetated with a mix of floating-leaf waterlilies (*Nymphaea, Nuphar* sp. and *Brasenia sp.*), variable watermilfoil, bladderwort, and tape grass (*Vallisneria sp.*). Vegetation distribution and bathymetry maps are provided in Figures 3 and 3a.

Adams Pond

Adams Pond is 19.2 acre pond with a maximum depth of 6.0 ft. and average depth of 4.6 ft. The pond had significantly less emergent growth along the shoreline. There was growth of the same submersed species as the other ponds in the system with the addition of a small patch of large-leaf pondweed (*Potamogeton amplifolius*). There was an observable reduction in waterlily density along the historic streambed, where water depths ranged from 5.0- 6.0 ft. The submersed plant growth was dominated by bladderwort. Vegetation distribution and bathymetry maps are provided in Figures 4 and 4a.

Arnold Pond

Arnold Pond, like the other ponds in the chain, is very shallow with an average depth of less than 3.0 ft. The vegetation assemblage and distribution is similar to those of the other ponds with a prominent emergent community and dense growth of submersed species and a canopy of waterlilies. Vegetation distribution and bathymetry maps are provided in Figures 5 and 5a.

Water Quality

Water quality sampling was conducted along the Stockwell Pond system in order to establish baseline data, reveal potential management concerns, and identify base flow and storm flow nutrient trends. The results from both the base flow and storm water sampling are provided in the following tables. The original laboratory repots are provided in Appendix B. Each water quality parameter is discussed in greater detail in the following paragraphs.

TABLE 1 – BASE FLOW WATER QUALITY ANALYSIS RESULTS

Sampling Location	Sampling Round	pH	Alkalinity	Phosphorus	Dissolved Phosphorus
		S.U.	mg $CaCo_3$/l	mg/l	mg/l
Station WP-01-02	August 2001	6.38	20.2	0.023	<0.010
	October 2001	6.75	21.7	<0.010	<0.010
	March	6.69	11.3	0.028	0.014
	April	6.65	15.6	0.020	<0.010
	May	6.77	13.7	0.012	<0.010
Station PP-02	August 2001	6.80	18.1	0.028	<0.010
	October 2001	7.00	24.7	<0.010	0.011
	March	6.67	11.8	0.017	<0.010
	April	6.60	15.2	0.017	<0.010
	May	6.58	11.8	<0.010	<0.010
Station SP-03-13	August 2001	6.44	16.7	0.018	<0.010
	October 2001	6.67	28.4	0.018	0.012
	March	6.70	12.1	0.011	<0.010
	April	6.62	14.3	0.011	<0.010
	May	6.67	11.7	<0.010	<0.010
Station AP-04	August 2001	6.73	<10.0	0.026	<0.010
	October 2001	6.88	13.7	0.011	<0.010
	March	6.81	10.2	0.012	<0.010
	April	6.78	10.4	<0.010	<0.010
	May	6.81	11.4	<0.010	<0.010
Station ARP-05	August 2001	6.88	14.7	0.016	<0.010
	October 2001	6.71	13.5	<0.010	<0.010
	March	6.80	<10.0	0.010	<0.010
	April	6.85	10.9	<0.010	<0.010
	May	6.67	13.0	0.014	<0.010
Station TFP-06-12	August 2001	6.97	15.2	0.017	<0.010
	October 2001	6.67	18.5	<0.010	<0.010
	March	6.91	10.8	<0.010	<0.010
	April	7.03	12.3	<0.010	<0.010
	May	7.01	12.2	<0.010	<0.010

TABLE 2 – STORM WATER SAMPLING RESULTS
March 2002 Storm Event

Sampling Location	Sampling Round	pH	Alkalinity	Phosphorus	Dissolved Phosphorus
		S.U.	mg $CaCO_3$/l	mg/l	mg/l
Station WP-01-02	Pre-Storm	6.67	10.5	<0.010	<0.010
	First Flush	6.64	10.2	0.011	<0.010
	Post-Storm	6.62	10.6	<0.010	<0.010
Station TFP-06-12	Pre-Storm	6.79	10.7	<0.010	<0.010
	First Flush	6.64	10.0	<0.010	<0.010
	Post-Storm	6.78	10.0	<0.010	<0.010

TABLE 3 – STORM WATER SAMPLING RESULTS
May 2002 Storm Event

Sampling Location	Sampling Round	pH	Alkalinity	Phosphorus	Dissolved Phosphorus
		S.U.	mg $CaCO_3$/l	mg/l	mg/l
Station WP-01-02	Pre-Storm	6.69	14.5	0.020	<0.010
	First Flush	6.64	14.6	0.026	0.020
	Post-Storm	6.56	12.0	0.016	<0.010
Station TFP-06-12	Pre-Storm	6.88	12.7	0.011	<0.010
	First Flush	6.68	11.1	0.017	<0.010
	Post-Storm	6.73	12.3	0.012	<0.010

TABLE 4 – MEAN BASE FLOW VALUES FOR ALL FIVE SAMPLING ROUNDS

Sampling Location	pH	Alkalinity	Phosphorus	Dissolved Phosphorus
	S.U.	mg $CaCO_3$/l	mg/l	mg/l
Station WP-01-02	6.65	16.5	0.019	<0.010
Station PP-02	6.73	16.3	0.016	<0.010
Station SP-03-13	6.62	16.6	0.014	<0.010
Station AP-04	6.80	11.1	0.014	<0.010
Station ARP-05	6.78	12.4	0.012	<0.010
Station TFP-06-12	6.92	13.8	<0.010	<0.010

pH – The pH ranged from 6.38-7.03 over the sampling period. The pH values obtained during the sampling program are well within the generally accepted range and are no cause for alarm.

The values fluctuated from round to round and site to site, but for the most part hovered just under neutral, which is considered the preferred pH for fish and other aquatic organisms. Generally a range of 5.5-8.5 is desired for the propagation of a healthy aquatic ecosystem; therefore, the pH levels throughout the Stockwell Pond system are not causing adverse effects on resident wildlife populations.

Alkalinity - is the measuring of the buffering capacity of a waterbody against acid additions, such as acid rain and pollutants. Generally a value greater than 20 mg/l is a sign that the waterbody is sufficiently protected against adverse pH fluctuations. The alkalinity values ranged from <10.0-28.4 mg/l. Although some of the values were relatively low, the mean values indicate that the waterbodies have low to moderate protection against acidic additions.

Phosphorus - is typically considered the limiting nutrient in freshwater systems. A value of 0.03 mg/l is sufficient to stimulate excessive plant and algae growth. The tested values ranged from <0.010-0.028 mg/l. All sample sites during each round had phosphorus levels below the maximum phosphorus threshold. Although, the values tended to be below the aforementioned threshold it was evident that there was a consistent increase in total phosphorus as the water moved through the system. This can best be seen by looking at the mean phosphorus values. The average phosphorus value as the water entered the system at the Town Farm Pond site was <0.010 mg/l. The values then steadily increased as one goes downstream until reaching the Welsh pond site where the average value was 0.019 mg/l. This trend is also echoed in the May storm water sampling.

Dissolved Phosphorus – is the portion of phosphorus that is in solution with the water. The total phosphorus analysis includes the phosphorus found in suspended particulate matter within the sample; whereas, dissolved phosphorus is the measure of phosphorus that is in solution only. Dissolved phosphorus is representative of the amount of phosphorus that is immediately available for use by plants and algae. It is generally recommended that a level of 0.01 mg/l or less be maintained to prevent nuisance algae blooms. Values from the Stockwell Ponds were, in most cases below 0.010 mg/l. Two or three spikes above the mean value of <0.010 mg/l were recorded; however, the values tended to remain relatively static from site to site and round to round, which was unlike the total phosphorus results. This data seems to indicate that there was an increase in phosphorus containing particulate matter, rather than forms of directly available phosphorus.

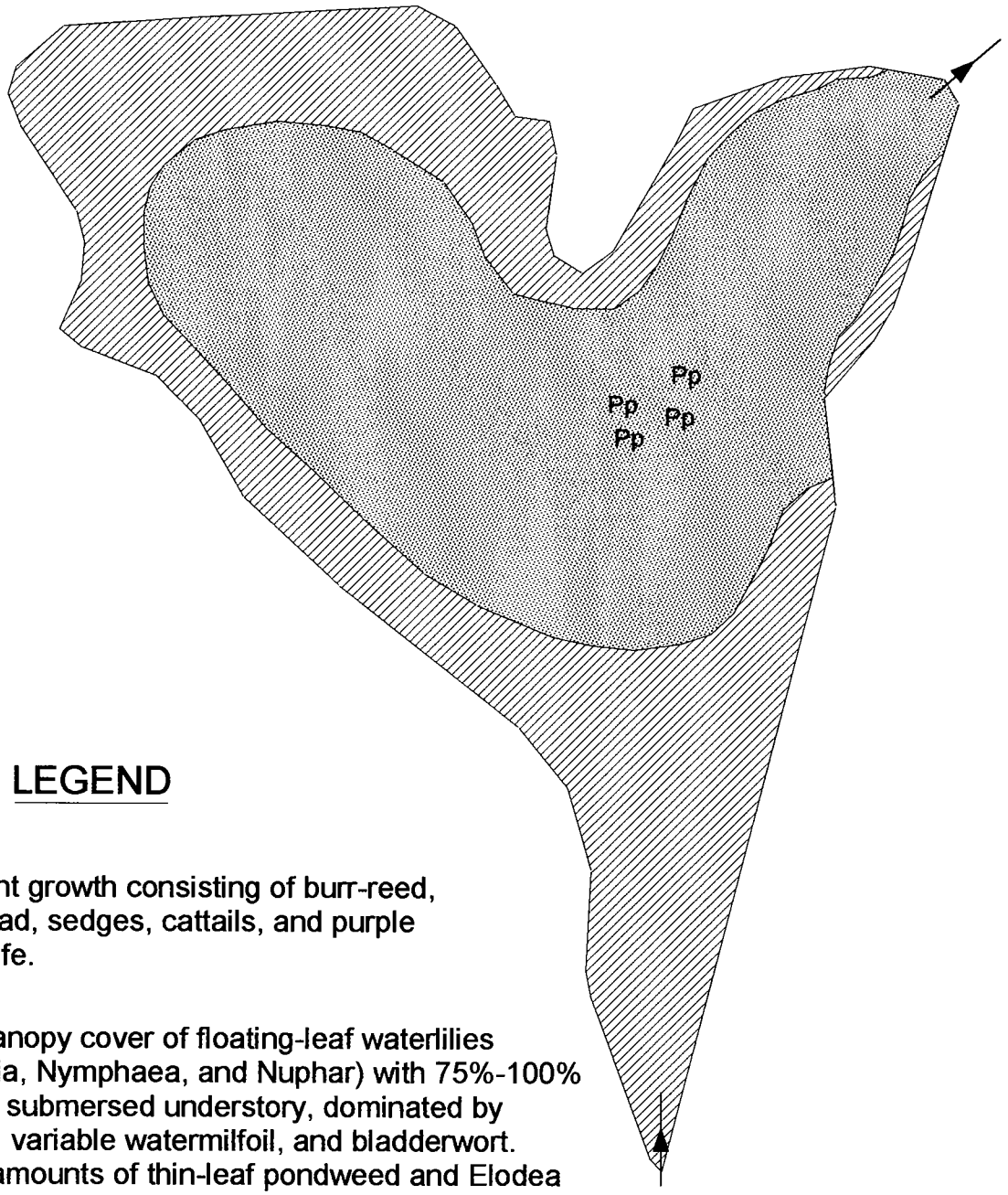
RECOMMENDATIONS

This investigation focused on establishing baseline data for the later quantification of nutrient loading estimates. Based on the very low phosphorus levels obtained during the entire sampling period for both the base flow and storm flow sampling the further reduction of phosphorus levels through the management of the Stockwell Ponds is questionable.

We recommend that the Association provide this report and data set to Dr. Ken Wagner of ENSR International for further review, and take steps to implementing additional sampling focusing on the direct storm water input (i.e. storm drains and direct overland flow) to Lake Singletary.

APPENDIX A

Vegetation Distribution and Bathymetry Maps



LEGEND

Emergent growth consisting of burr-reed, arrowhead, sedges, cattails, and purple loosestrife.

100% canopy cover of floating-leaf waterlilies (Brasenia, Nymphaea, and Nuphar) with 75%-100% cover of submersed understory, dominated by coontail, variable watermilfoil, and bladderwort. Lesser amounts of thin-leaf pondweed and Elodea were also observed throughout this area.

Pp = Dense isolated stand of thin-leaf pondweed.

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WELSH POND
VEGETATION MAP

Stockwell Ponds Survey
Sutton, MA

Worcester South
USGS Quadrangle

FIGURE 1

SCALE:
20 0 20 40 60 Feet

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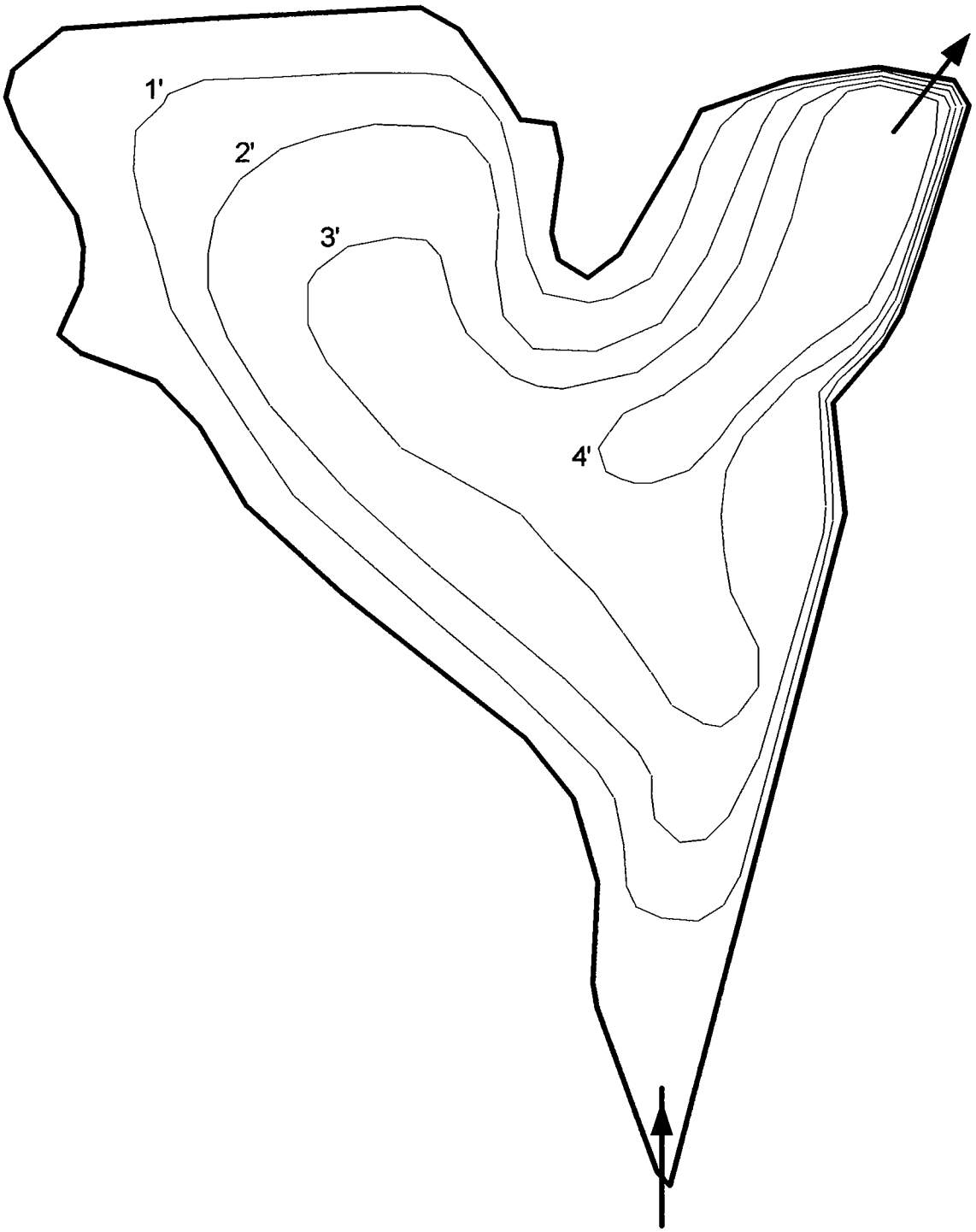

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WELSH POND
BATHYMETRY MAP

Stockwell Ponds Survey
Sutton, MA

Worcester South
USGS Quadrangle

FIGURE 1A

Depth contours measured in feet and depicted in one foot increments.

SCALE:

20 0 20 40 Feet

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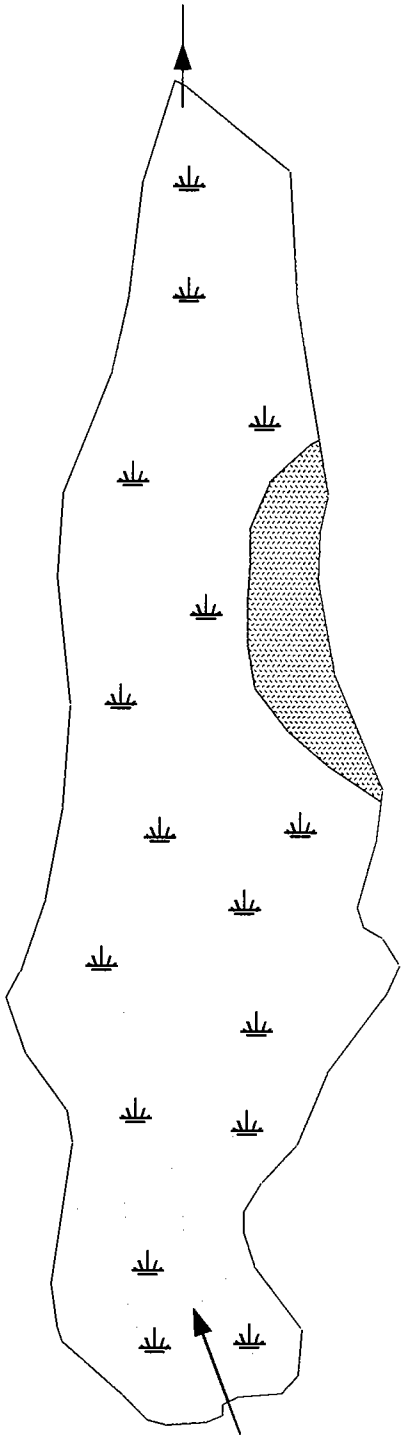

LEGEND

Emergent cattail marsh with scattered growth of purple loosestrife.

Isolated stand of the exotic and invasive plant common reed (Phragmites australis).

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PUTNAM POND
VEGETATION MAP

Stockwell Ponds Survey
Sutton, MA

Worcester South
USGS Quadrangle

FIGURE 2

SCALE:
30 0 30 60 Feet

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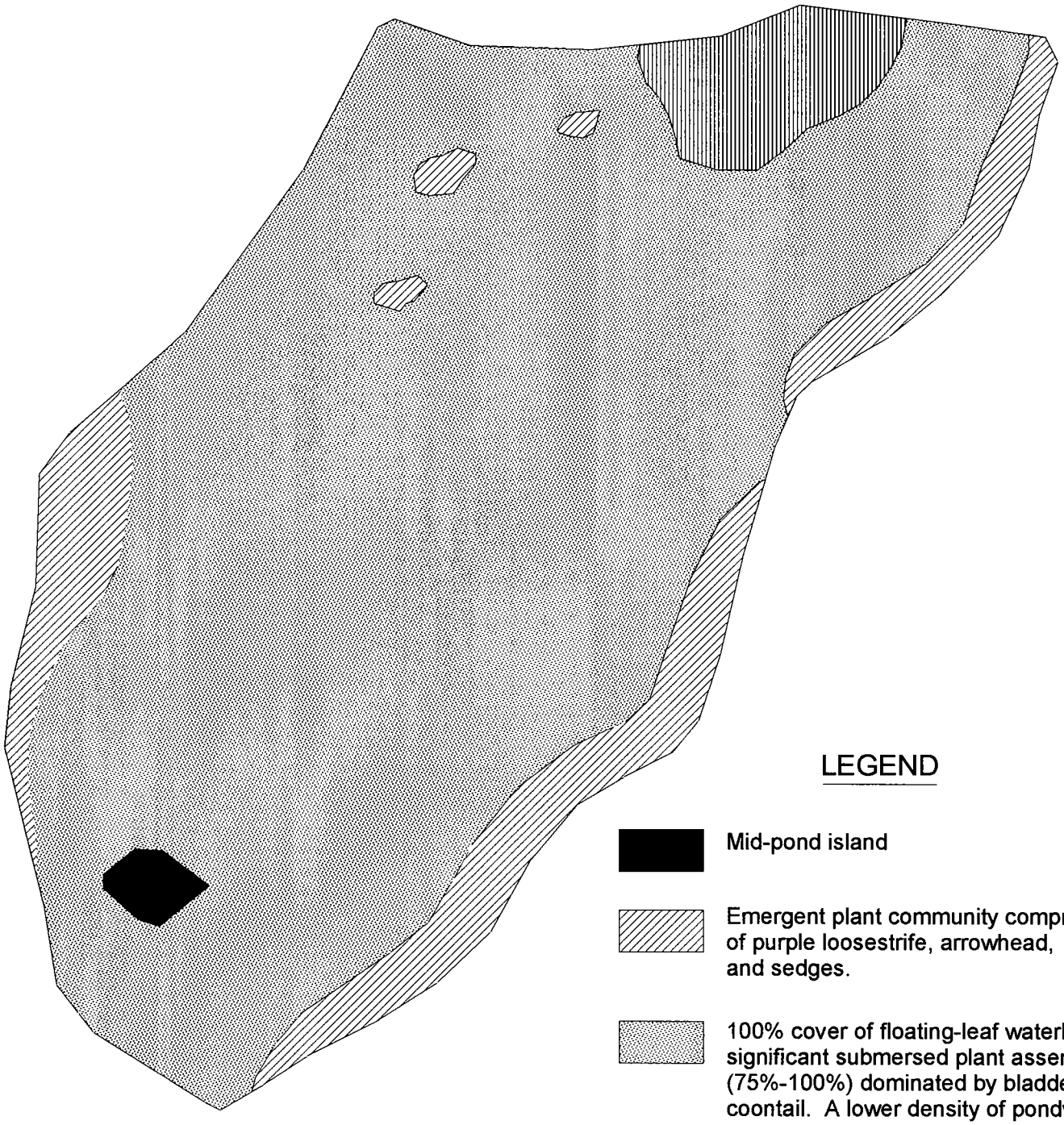

LEGEND

- Mid-pond island
- Emergent plant community comprised of purple loosestrife, arrowhead, and sedges.
- 100% cover of floating-leaf waterlilies with a significant submersed plant assemblage (75%-100%) dominated by bladderwort and coontail. A lower density of pondweeds were also present.
- Dense growth of the exotic and invasive plant variable watermilfoil (Myriophyllum heterophyllum)

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SCHOOLHOUSE POND

VEGETATION MAP

Stockwell Ponds Survey
Sutton, MA

Worcester South USGS Quadrangle

FIGURE 3

SCALE:

20 0 20 Feet

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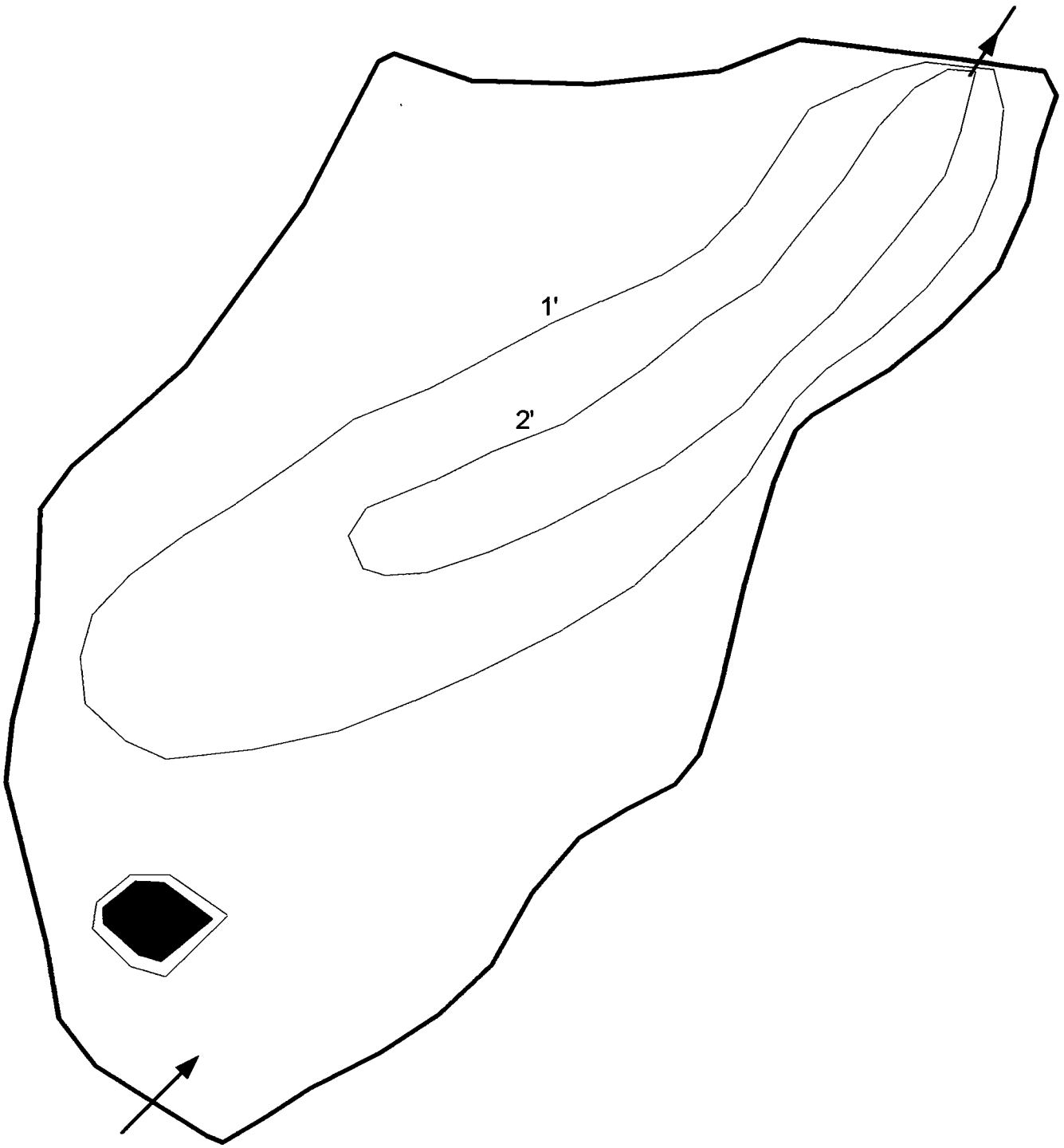

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SCHOOLHOUSE POND

BATHYMETRY MAP

Stockwell Ponds Survey
Sutton, MA

Worcester South
USGS Quadrangle

FIGURE 3A

Depth contours measured in feet and depicted in one foot increments.

SCALE:

20 0 20 Feet

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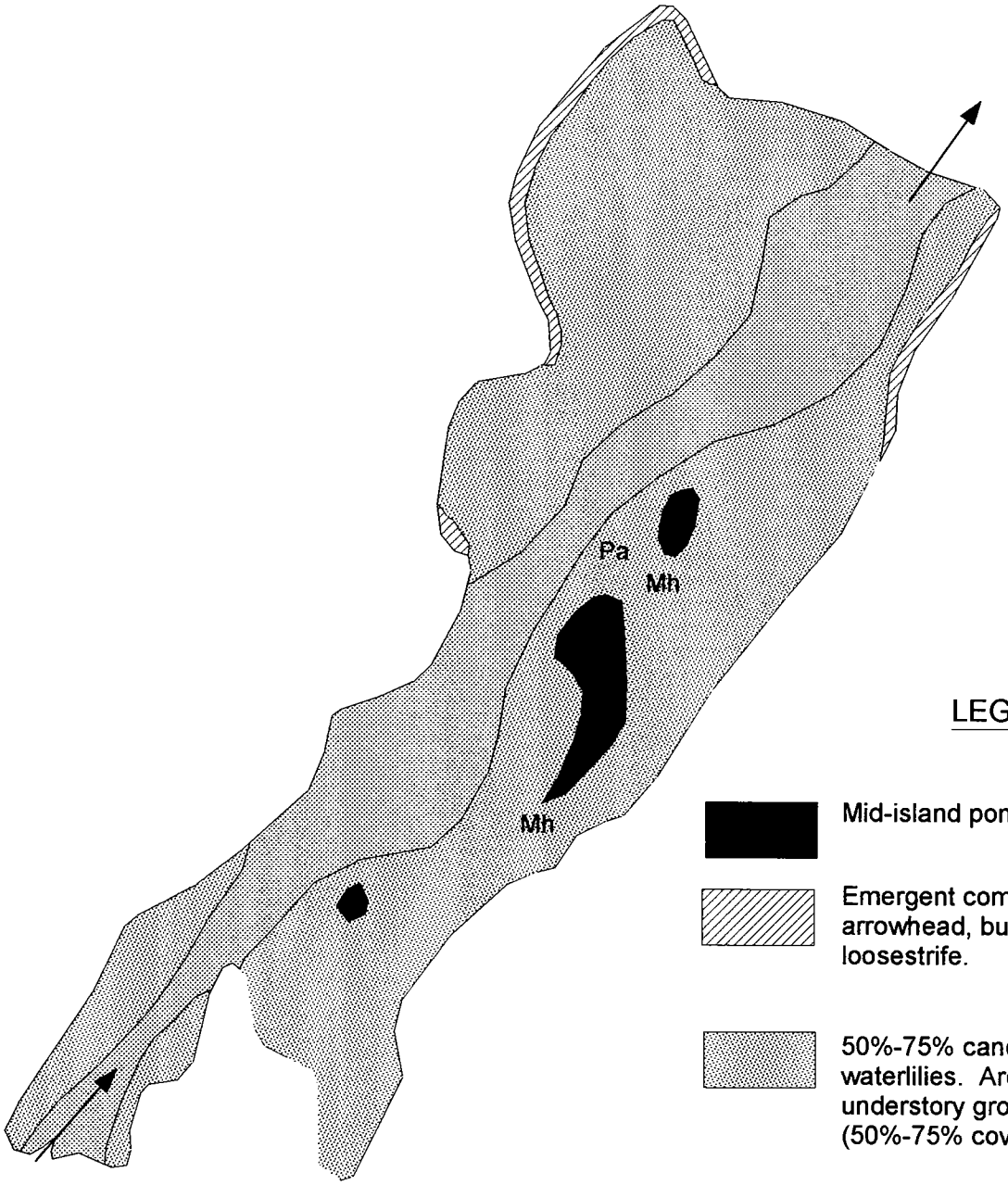

LEGEND

Mid-island ponds

Emergent community consisting of arrowhead, burr-reed, and purple loosestrife.

50%-75% canopy cover of floating-leaf waterlilies. Area also has significant understory growth of bladderwort (50%-75% cover).

Sparse growth of floating-leaf waterlilies. Area dominated by bladderwort growth.

Mh Low density growth of variable watermilfoil

Pa Scattered growth of large-leaf pondweed.

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ADAMS POND
VEGETATION MAP

Stockwell Ponds Survey
Sutton, MA

Worcester South
USGS Quadrangle

FIGURE 4

SCALE:
40 0 40 80 Feet

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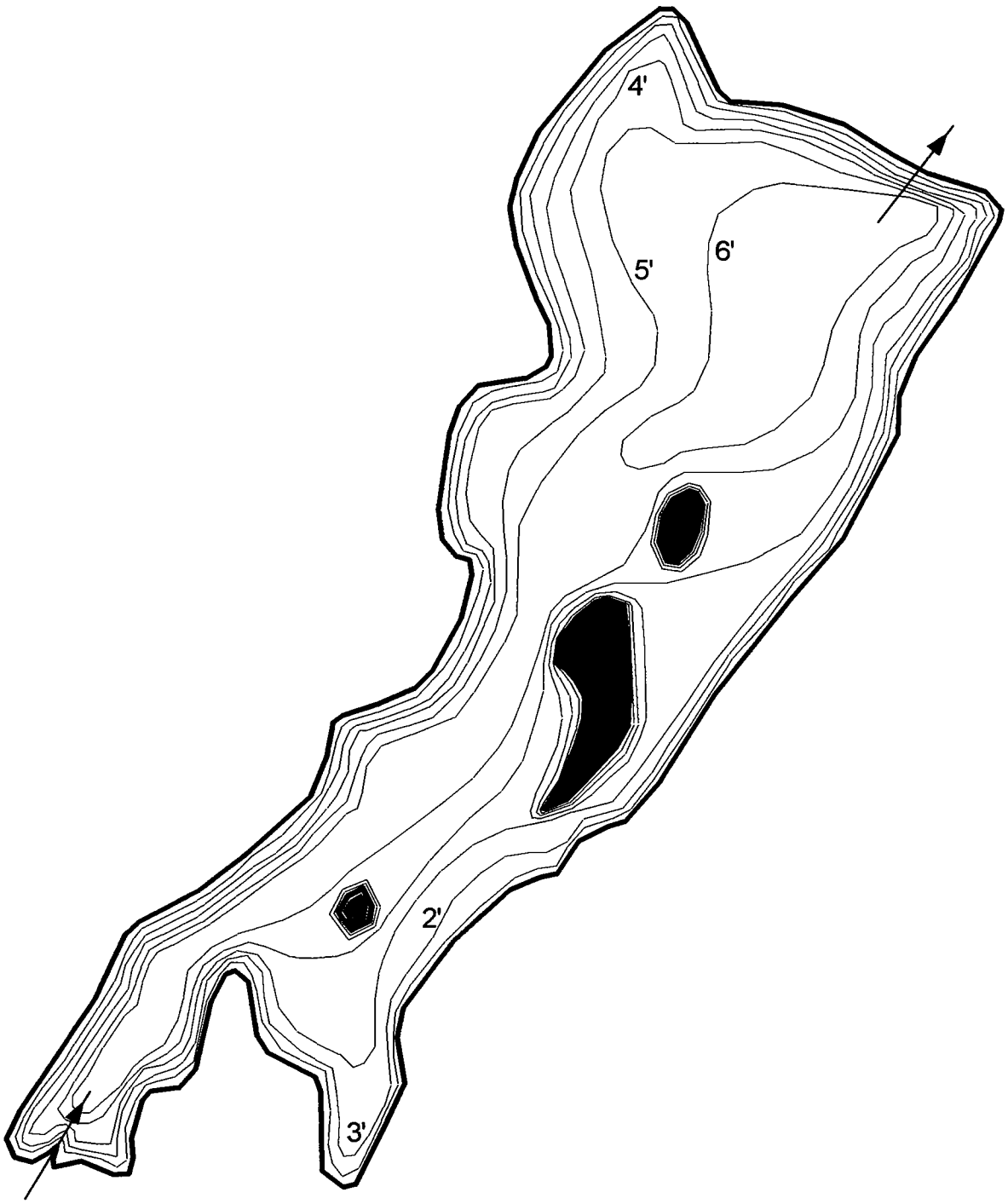

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ADAMS POND

BATHYMETRY MAP

Stockwell Ponds Survey
Sutton, MA

Worcester South
USGS Quadrangle

FIGURE 4A

Depth contours measured in feet and depicted in one foot increments.

SCALE:

40 0 40 80 Feet

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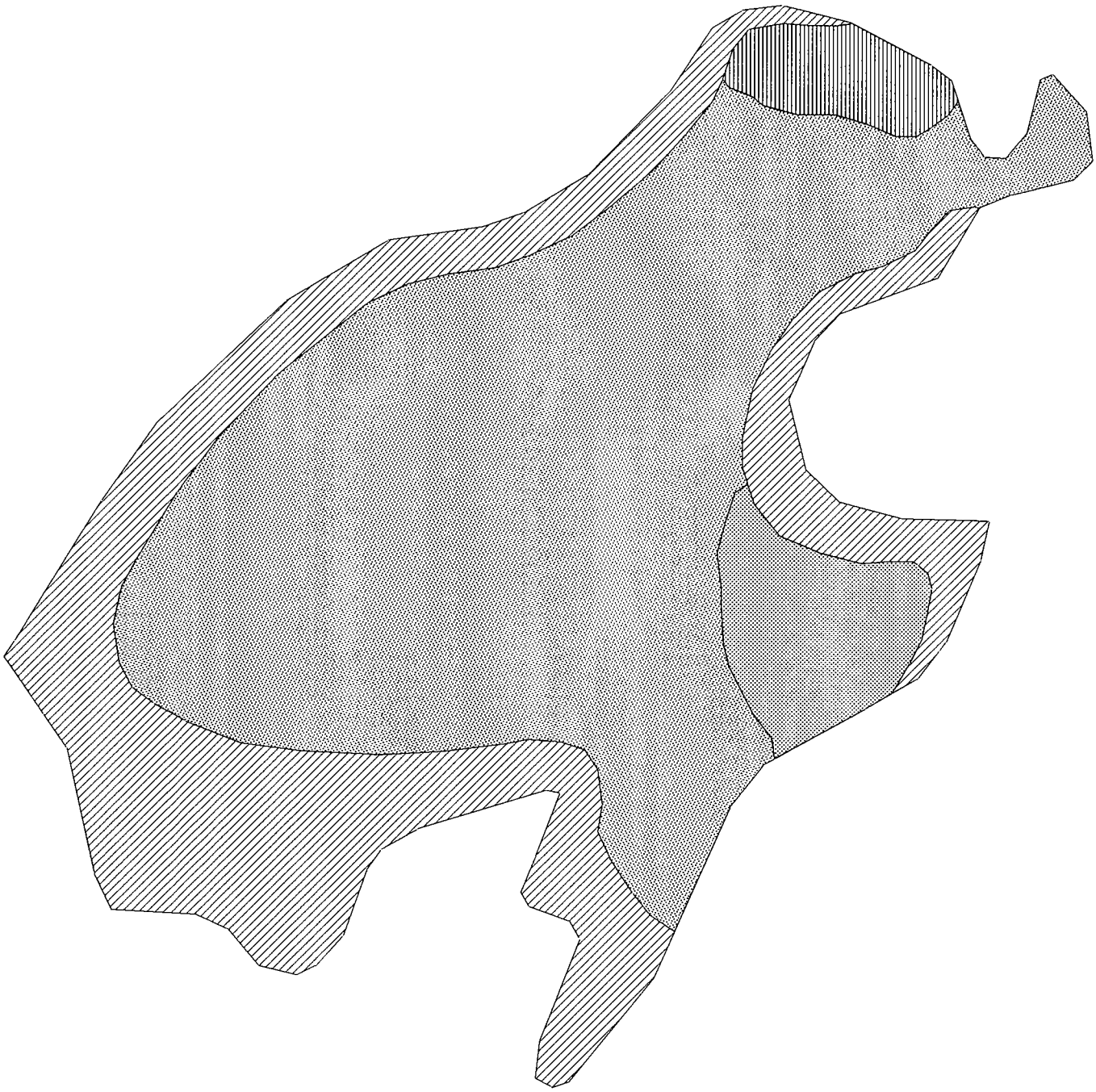

LEGEND

- Encroaching emergent community comprised of purple loosestrife, rushes, and burr-reed.
- 75%-100% floating-leaf waterlily cover. Submersed plants dominated by variable watermilfoil, bladderwort, tape grass.
- Reduced waterlily canopy with increased density of the submersed species bladderwort and variable watermilfoil.
- Dense monoculture stand of the exotic and invasive plant variable watermilfoil.

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ARNOLD POND
VEGETATION MAP

Stockwell Ponds Survey
Sutton, MA

Worcester South
USGS Quadrangle

FIGURE 5

SCALE:

20 0 20 40 Feet

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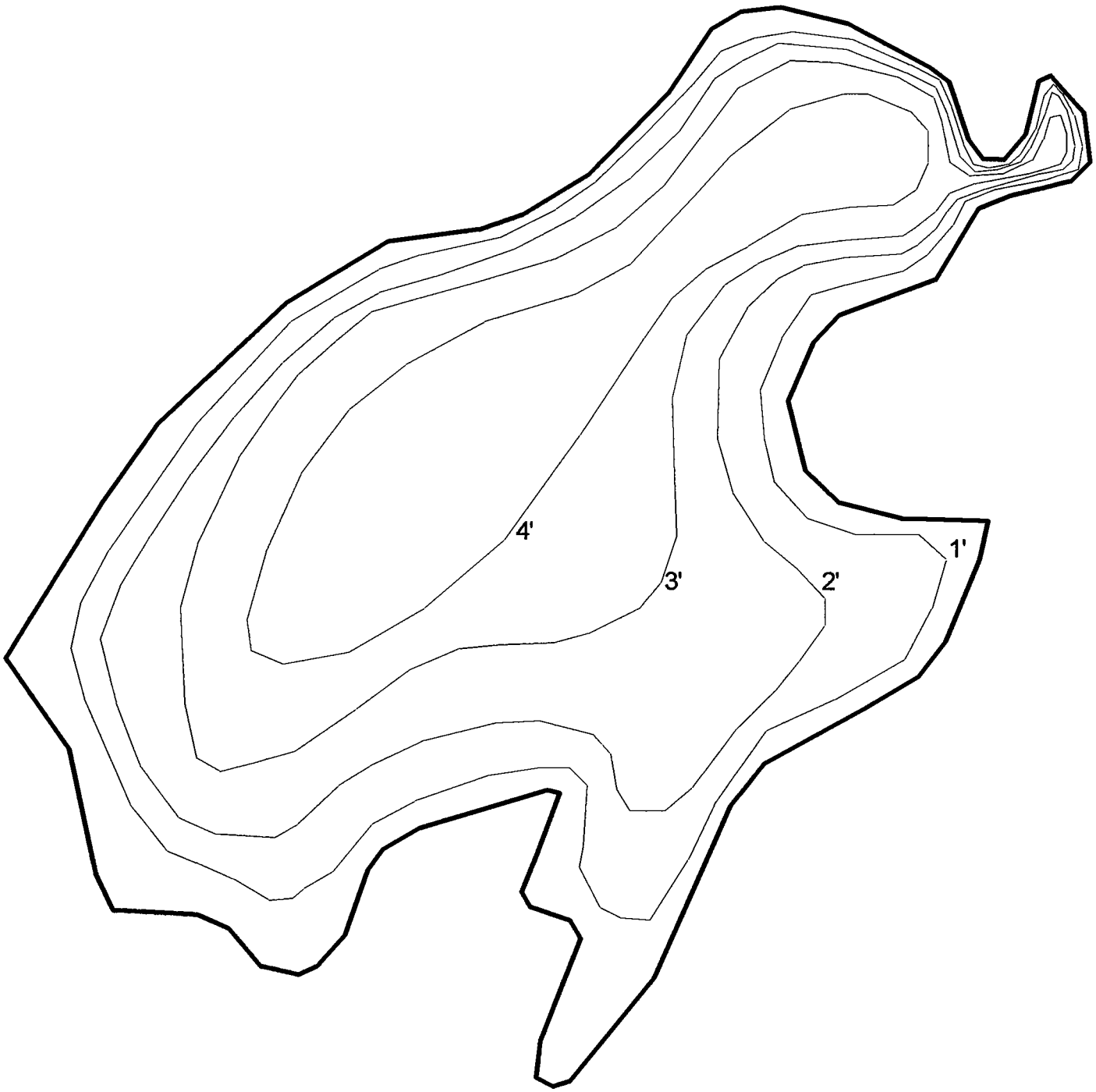

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ARNOLD POND
BATHYMETRY MAP

Stockwell Ponds Survey
Sutton, MA

Worcester South
USGS Quadrangle

FIGURE 5A

Depth contours measured in feet and depicted in one foot increments.

SCALE:

20 0 20 40 Feet

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